ANNUAL FISH PASSAGE REPORT
ROCK ISLAND DAM
COLUMBIA RIVER, WASHINGTON
1960

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ANNUAL FISH PASSAGE REPORT - ROCK ISLAND DAM COLUMBIA RIVER, WASHINGTON, 1960

by

Paul D. Zimmer and Clifton C. Davidson

United States Fish and Wildlife Service
Special Scientific Report--Fisheries No. 419

Washington, D. C.
April 1962

IN MEMORIAM

This annual report of fishway operations at Rock Island Dam in 1960 is dedicated to the memory of co-author Clifton C. Davidson, fishway superintendent. Mr. Davidson, by his lifelong devotion to duty and wholehearted cooperative spirit, was an inspiration to all his associates.

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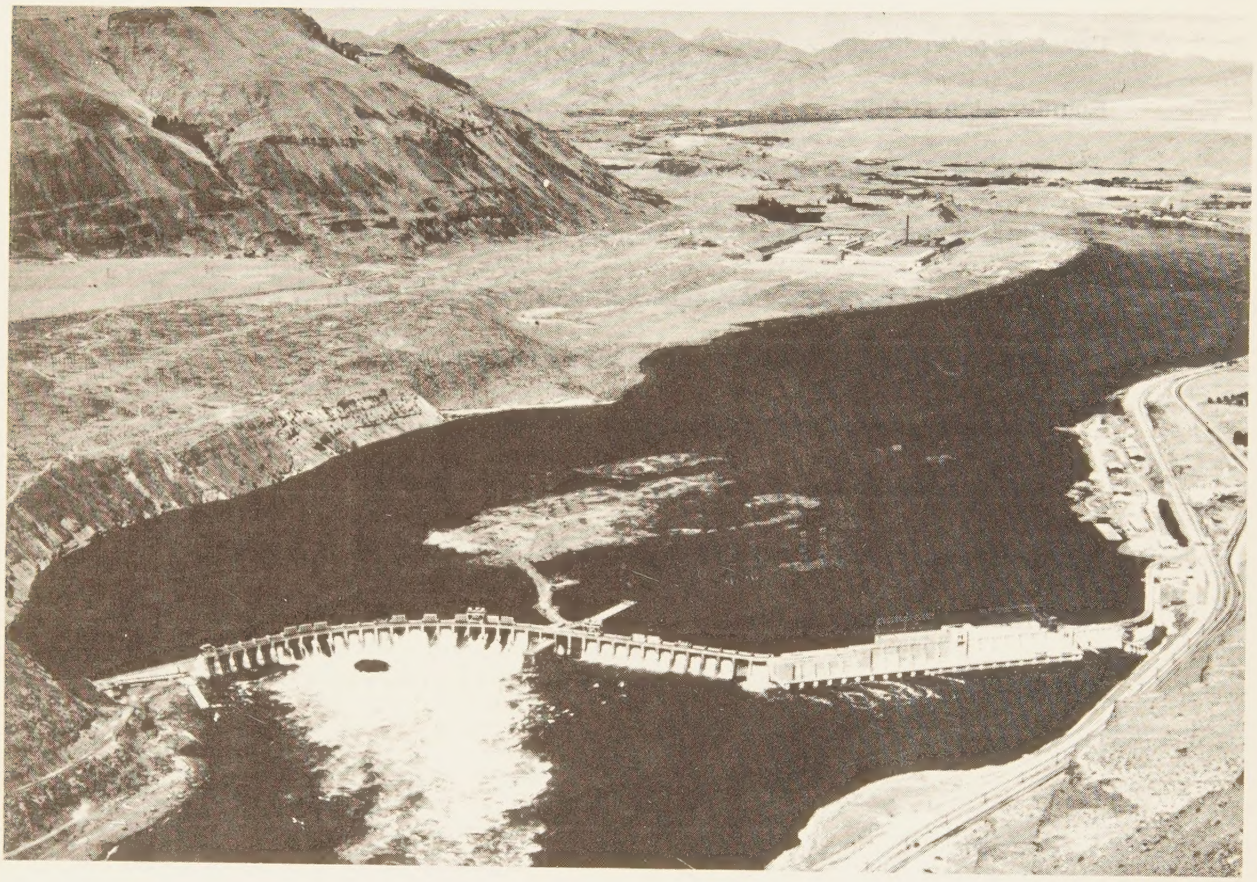

Rock Island Dam, Columbia River, Washington

ANNUAL FISH PASSAGE REPORT - ROCK ISLAND DAM COLUMBIA RIVER, WASHINGTON, 1960

by

Paul D. Zimmer, Clifton C. Davidson
Fishery Biologists (Management)

ABSTRACT

Important runs of salmon and steelhead trout pass Rock Island Dam on the Columbia River. Annual records of fish movement past the dam are available from 1933.

Count of 26,550 chinook salmon in 1960 is slightly more than half the peak year of 1957. Sockeye salmon count of 60,341 exceeded the 27-year mean of 52,823. Only 94 coho salmon were recorded. Greatest count of coho salmon, 229, occurred in 1947. Numbers of steelhead trout passing Rock Island Dam increased in 1960. The 27-year mean of 2,946 steelhead trout was less than the 1960 count of 6,226. Approximately 150,660 fish other than salmon and steelhead trout passed Rock Island Dam in 1960.

INTRODUCTION

Rock Island Dam, located on the Columbia River approximately 12 miles downstream from the city of Wenatchee, Wash., has been in operation since 1933. The plant is owned and operated by Chelan County Public Utility District No. 1.

This report on passage of fish at Rock Island Dam during 1960 provides information on operation of fishways and numbers of fish utilizing upstream fish passage facilities.

Rock Island Dam is equipped with three fishways: one located on the right bank, another on the left bank, and a third approximately in the center of the dam.

Biological data secured at Rock Island Dam are useful in management of the Columbia River fishery resource and in planning fish facilities at other dams.

COUNTING PROCEDURES

Counting of fish at Rock Island Dam in 1960 began on May 2 and ended October 29. Counting was conducted on a full-time basis throughout each day's period of daylight. During the period May 2 to September 15 counts were made 16 hours each day; September 16-30, 12; and October 1-29, 8 hours at right and middle ladders and 12 hours at left bank fishway. A 15-minute rest period was allowed each hour. During periods of noncounting the three fishways were closed to upstream movement of fish.

Note.--Paul D. Zimmer and Clifton C. Davidson (deceased), Bureau of Commercial Fisheries Columbia Fisheries Program Office, U.S. Fish and Wildlife Service, Portland, Ore.

ENUMERATION OF FISH

Chinook Salmon, *Oncorhynchus tshawytscha*

The chinook salmon count in 1960 of 26,550 is well above the mean of 15,153 for the 27-year period, 1933-59. The count increased from that of 1959 (Zimmer, Davidson, and Anders[1]), and was slightly more than half the annual fish count of 50,713 in 1957 (table 1). Monthly totals of chinook salmon counted are given in table 2. Maximum day's count in 1960 was 401 fish on August 3 (table 3). In 1960 peak movement of chinook salmon (jacks included) occurred on August 3, when 516 fish were counted through the fishways.

Tables 4 and 5 show semimonthly totals of number and percentage of chinook salmon counted through each fish ladder in 1960.

Data pertaining to chinook salmon daily counts are contained in tables 6-11.

Chinook Salmon Jacks

Some chinook salmon return from the ocean during the year following their seaward migration and are referred to as "jacks." These fish are predominantly males and are smaller than the average. It has been determined at Rock Island Dam that up to June 30 of each year jacks rarely, if ever, exceed 18 inches in length, while the balance of the fish appreciably exceed that length. Likewise, from July 1 to the end of the season jacks rarely, if ever, exceed 22 inches in length. Consequently, jacks at Rock Island Dam are identified by considering all chinook salmon 18 inches or less in length prior to July 1 as jacks, and all chinook salmon 22 inches or less in length subsequent to June 30 as jacks. Monthly totals of jacks counted in 1960 are given in table 2. In 1960, the maximum day's count of chinook salmon jacks, 128, occurred on August 10 (table 3). The 5,082 fish recorded as jacks constitute 19.1 percent of the total 1960 chinook salmon run.

Data pertaining to semimonthly counts of chinook salmon jacks utilizing each fish ladder at Rock Island Dam in 1960 are given in table 5.

Sockeye Salmon, *Oncorhynchus nerka* (blueback or red)

The sockeye salmon count of 60,341 for 1960 was greater than the 27-year mean of 53,092 (table 1). In 1960, peak of the run was reached on July 19, when 3,524 fish were counted through the fishway at Rock Island Dam.

In recent years attention has been drawn to the many small sockeye salmon at Rock Island Dam. During the 1960 counting period sockeye salmon under 16 inches in length were enumerated as small fish. Number of sockeye salmon recorded as "small" was 6,335 (10.5 percent).

Monthly totals of sockeye salmon counted in 1960 are given in table 2.

Data pertaining to sockeye salmon daily counts are contained in tables 8-11.

Tables 12 and 13 show semimonthly totals of number and percentage of sockeye salmon ascending each fishway. Of the sockeye salmon passing Rock Island Dam in 1960, 61.52 percent ascended the left ladder, while 22.36 and 16.11 percent ascended the middle and right ladders, respectively.

Coho Salmon, *Oncorhynchus kisutch* (silver)

The coho salmon count of 94 in 1960 was greater than the 27-year mean of 63 and is the sixth highest count recorded at Rock Island Dam for this species (table 1). Monthly totals of coho salmon counted in 1960 are given in table 2. Maximum day's count in 1960 of 11 fish occurred on September 24. Daily counts of coho salmon passing the dam are given in tables 10 and 11.

Steelhead Trout, *Salmo gairdneri*

The steelhead trout count of 6,226 in 1960 was higher than those of the preceding 4 years

[1] Zimmer, Paul D., Clifton C. Davidson, and Floyd S. Anders. 1961. Annual fish passage report, Rock Island Dam, 1959. U.S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 394, p. 1-14.

and is well above the 27-year mean of 2,946 (table 1). Monthly totals of steelhead trout counted are given in table 2.

Maximum day's count in 1960 was 198 on September 20 (table 3).

Additional data pertaining to steelhead trout daily counts are contained in tables 6-11.

Semimonthly totals of number and percentage of steelhead trout ascending each fish ladder are given in table 14.

Miscellaneous Fish

In 1960, enumeration was made of species of fish other than salmon and steelhead trout passing Rock Island Dam. Data pertaining to these fish are given in tables 15-20. No claims are made as to complete accuracy of identification of these fish. It is felt, however, that the degree of accuracy is consistent with that maintained at other dams on the Columbia River and as such may be used as a rough index of abundance of these fish. In 1960, approximately 150,660 fish other than salmon and steelhead trout passed Rock Island Dam. Species of fish included are: largescale sucker, *Catostomus macrocheilus* Girard; longnose sucker, *Catostomus catostomus* (Forster); squawfish, *Ptychocheilus oregonense* (Richardson); Rocky Mountain whitefish, *Prosopium williamsoni* (Girard); Columbia River chub, *Mylocheilus caurinus* (Richardson); chiselmouth, *Acrocheilus alutaceus* Agassiz and Pickering; carp, *Cyprinus carpio* Linnaeus; Dolly Varden trout, *Salvelinus malma* (Walbaum); and rainbow trout, *Salmo gairdneri* Richardson.

WEATHER AND RIVER DISCHARGE DATA

Headwater and tailwater elevations are plotted on figures 1 and 2, respectively. Water and air temperatures were taken by pocket thermometer. Water temperatures given are average of morning and afternoon surface readings. Daily records of weather conditions and stream flows are shown in tables 6-11. Daily river discharge data are plotted in figure 3.

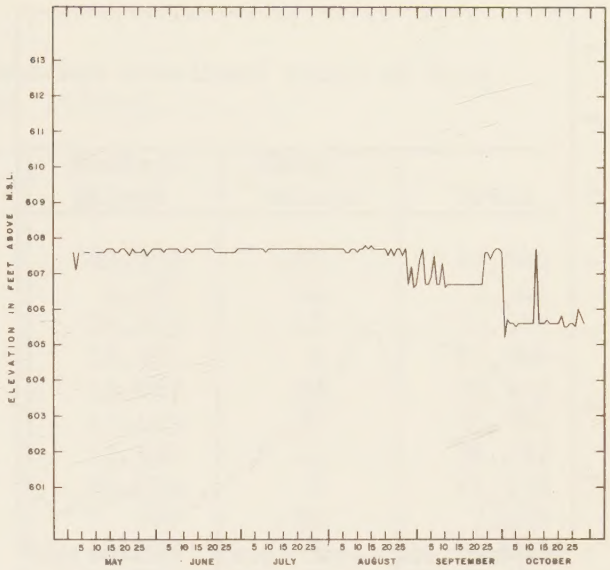

Figure 1.--Headwater elevations, Rock Island Dam, May 2 to October 29, 1960.

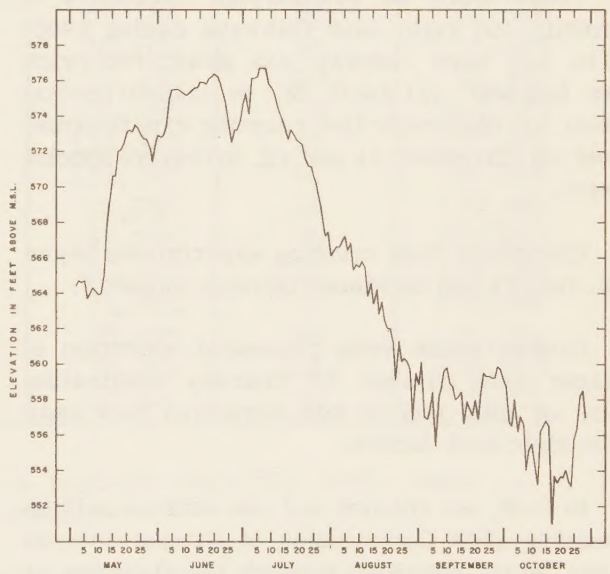

Figure 2.--Tailwater elevations, Rock Island Dam, May 2 to October 29, 1960.

ACTIVITIES AND OBSERVATIONS

Arrival time of the first chinook salmon at Rock Island Dam in 1960 was 15 days earlier than in 1959. In spite of this early arrival of fish, the peak day's movement of chinook salmon occurred on August 3, 70 days later than in 1959.

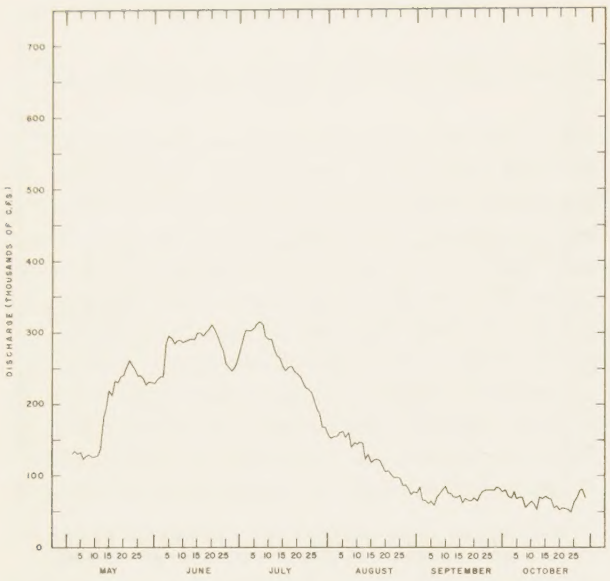

Figure 3.--Daily river discharge, Rock Island Dam, May 2 to October 29, 1960.

There were no dewaterings necessary of middle and right bank fishways during 1960. The left bank fishway was dewatered twice as follows: (1) April 28, to install special weir for electronic fish counting experiments; and (2) November 11 and 12, to remove special weir.

Electronic fish counting experiments began on July 21 and continued through August 5.

Broken guide rails prevented operation of crest gate number 37, thereby eliminating use of this gate to add attraction flow near the right bank ladder.

In 1960, six chinook and one sockeye salmon bearing Fish Commission of Oregon colored tags were recorded through the fishways at Rock Island Dam.

SUMMARY

1. Total count of salmon and steelhead trout at Rock Island Dam was 93,211 in 1960. This was less than the 1959 count of 99,959 but exceeded the 27-year mean of 70,983.

2. Yearly total counts of salmon and steelhead trout passing Rock Island Dam during the period 1933-60, inclusive, are given in table 1.

3. The chinook salmon count of 26,550 in 1960 exceeded the total for this species in 1959 and was slightly greater than half the peak year of 1957. In 1960, 5,082 jacks were recorded, representing 19.1 percent of that year's count.

4. The sockeye salmon count of 60,341 in 1960 was less than in 1959 but exceeded the 27-year mean of 52,824. Small sockeye under 16 inches in length comprised 10.5 percent of the run. A greater percentage of sockeye utilized the left bank ladder than used either the middle or right bank ladders.

5. Few coho salmon have appeared at Rock Island Dam in the period 1933-60. Greatest count of this species of salmon occurred in 1947, when 229 fish were recorded. The 1960 count of 94 was less than that of 1959 but exceeded the 27-year mean of 60.

6. The steelhead trout count of 6,226 in 1960 exceeded all previous records and was well above the 27-year mean of 2,946.

7. Although no quantitative data are available, it was the impression of the fishway superintendent and the counters that the incidence of injured fish was probably less than half that observed in 1959.

8. Fish other than salmon and steelhead trout passing Rock Island Dam in 1960 totalled approximately 150,660.

9. Fish counting was begun on May 2 and ended October 29.

10. Maximum number of salmonids counted in 1 day during the 1960 season was 3,574 on July 19.

Table 1.--Annual counts of salmon and steelhead trout at Rock Island Dam, 1933-60.

Year	Chinook salmon	Steelhead trout	Sockeye salmon	Coho salmon	Total
1933	5,668 1/	1,055 1/	40,737	182	47,642
1934	6,482 1/	583	2,227	69	9,361
1935	16,310 1/	5,412 1/	14,013	10	35,745
1936	7,396 1/	2,369 1/	16,501	0	26,266
1937	5,133	2,214 1/	15,087	58	22,492
1938	5,803	2,400 1/	17,123	78	25,404
1939	11,206	5,427 1/	19,591	13	36,237
1940	9,492	5,550	26,894	2	41,938
1941	2,571	3,561	949	29	7,110
1942	6,814	3,586	16,282	1	26,683
1943	11,145	2,249	17,665	22	31,081
1944	3,375	1,329	4,932	186	9,822
1945	5,696	1,121	7,142	166	14,125
1946	9,992	1,761	45,029	32	56,814
1947	11,766	2,115	79,834	229	93,944
1948	7,083	2,360	84,184	29	93,656
1949	12,353	2,470	18,600	40	33,463
1950	10,348	1,852	50,134	72	62,406
1951	18,752	3,121	101,826	8	123,707
1952	20,121	2,883	114,349	27	137,380
1953	31,080	4,001	151,747	40	186,868
1954	33,283	5,407	91,234	44	129,968
1955	25,658	3,141	155,055	39	183,893
1956	25,085	1,540	92,443	29	119,097
1957	50,713	3,927	71,621	27	126,288
1958 2/	32,457	3,970	98,695	60	135,182
1959 2/	23,352	4,138	72,351	118	99,959
1960	26,550	6,226	60,341	94	93,211

1/ Incomplete count.
2/ Counts for the period from May 4 through July 15, 1959, were computed by extrapolating sample counts.

Table 2.--Monthly totals of all anadromous fish counted at Rock Island Dam, 1960.

Species	May	June	July	August	Sept.	Oct.	Total
Chinook (except jacks)	5,373	3,606	4,428	4,367	3,070	624	21,468
Chinook (jacks)	624	602	536	1,325	1,783	212	5,082
Steelhead	752	32	74	1,327	2,992	1,049	6,226
Sockeye (large)	0	112	44,109	9,255	528	2	54,006
Sockeye (small)	0	27	4,923	1,316	69	0	6,335
Coho	0	0	0	0	52	42	94
Total fish	6,749	4,379	54,070	17,590	8,494	1,929	93,211

Table 3.--Maximum daily counts, salmon and steelhead, Rock Island Dam, 1960.

Species	Date	Number of fish
Chinook (except jacks)	Aug. 3	401
Chinook (jacks)	Aug. 10	128
Steelhead	Sept. 20	198
Sockeye (large)	July 19	3,123
Sockeye (small)	July 15	354
Coho	Sept. 24	11

Table 4.--Number and percent of chinook salmon counted over each fish ladder, Rock Island Dam, 1960 (jacks not included).

Date	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	
May 2-15	702	40.67	188	10.89	836	48.44	1,726
May 16-31	1,301	35.67	1,847	50.65	499	13.68	3,647
June 1-15	502	37.30	799	59.36	45	3.34	1,346
June 16-30	1,214	53.72	827	36.59	219	9.69	2,260
July 1-15	2,036	79.41	288	11.23	240	9.36	2,564
July 16-31	1,524	81.76	146	7.83	194	10.41	1,864
Aug. 1-15	2,595	86.90	79	2.65	312	10.45	2,986
Aug. 16-31	1,079	78.13	43	3.11	259	18.76	1,381
Sept. 1-15	1,333	85.61	28	1.80	196	12.59	1,557
Sept. 16-30	1,234	81.56	32	2.11	247	16.33	1,513
Oct. 1-15	427	86.97	17	3.46	47	9.57	491
Oct. 16-29	110	82.71	5	3.76	18	13.53	133
Total	14,057	65.48	4,299	20.02	3,112	14.50	21,468

Table 5.--Number and percent of chinook salmon jacks counted over each fish ladder, Rock Island Dam, 1960.

Date	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	
May 2-15	56	39.16	26	18.18	61	42.66	143
May 16-31	190	39.50	202	42.00	89	18.50	481
June 1-15	128	46.38	126	45.65	22	7.97	276
June 16-30	149	45.71	128	39.26	49	15.03	326
July 1-15	209	77.41	29	10.74	32	11.85	270
July 16-31	230	86.47	9	3.38	27	10.15	266
Aug. 1-15	724	87.97	14	1.70	85	10.33	823
Aug. 16-31	411	81.87	18	3.59	73	14.54	502
Sept. 1-15	916	80.92	25	2.21	191	16.87	1,132
Sept. 16-30	487	74.81	32	4.92	132	20.27	651
Oct. 1-15	120	81.08	7	4.73	21	14.19	148
Oct. 16-29	51	79.69	2	3.12	11	17.19	64
Total	3,671	72.24	618	12.16	793	15.60	5,082

Table 6.--Daily temperatures, stream flow, and fish count data, Rock Island Dam, May 1960.

Date	Air temperatures Max.	Air temperatures Min.	Water temperature 1/	Stream flow (c.f.s.)	Chinook	Sockeye	Coho	Steelhead	Total
May 1	--	--	--	--	--	--	--	--	--
2	71	51	48	131,000	0	0	0	4	4
3	72	51	48	133,600	4	0	0	20	24
4	66	47	47	131,000	4	0	0	44	48
5	66	48	48	132,700	8	0	0	24	32
6	60	50	49	123,300	105	0	0	54	159
7	60	50	48	126,700	106	0	0	40	146
8	61	43	48	128,400	129	0	0	47	176
9	75	47	48	126,700	211	0	0	33	244
10	79	50	49	125,800	392	0	0	42	434
11	81	56	48.5	126,700	244	0	0	46	290
12	75	48	48.5	139,100	311	0	0	73	384
13	65	50	49	181,700	163	0	0	37	200
14	67	48	48	195,400	108	0	0	10	118
15	68	46	48	218,100	84	0	0	24	108
16	62	48	48	211,200	102	0	0	32	134
17	62	44	48	233,100	116	0	0	30	146
18	64	48	48.5	230,000	399	0	0	24	423
19	59	48	48	237,800	223	0	0	16	239
20	54	47	48.5	240,000	283	0	0	38	321
21	54	41	48	249,000	278	0	0	28	306
22	58	39	48	262,200	407	0	0	22	429
23	66	39	49	253,900	354	0	0	25	379
24	62	44	49	249,000	238	0	0	19	257
25	61	45	49	239,400	248	0	0	3	251
26	65	50	50	241,000	248	0	0	8	256
27	65	47	50	236,200	315	0	0	2	317
28	75	45	50	227,000	296	0	0	2	298
29	77	48	50.5	231,500	279	0	0	2	281
30	74	54	51	230,000	159	0	0	0	159
31	74	52	51	228,500	183	0	0	3	186

1/ Surface temperatures, taken with pocket thermometer, are given in degrees Fahrenheit.

Table 7.--Daily temperatures, stream flow, and fish count data, Rock Island Dam, June 1960.

Date	Air temperatures Max.	Air temperatures Min.	Water temperature 1/	Stream flow (c.f.s.)	Chinook	Sockeye	Coho	Steelhead	Total
June 1	82	59	51.5	234,700	73	0	0	4	77
2	86	59	52	237,800	108	0	0	6	114
3	84	54	52	237,800	182	0	0	1	183
4	78	56	52	283,900	231	0	0	1	232
5	82	59	52	295,400	143	0	0	1	144
6	74	58	52	291,600	139	0	0	2	141
7	73	48	52	283,900	64	0	0	1	65
8	80	50	51.5	287,700	79	0	0	1	80
9	84	58	52	287,700	75	0	0	2	77
10	84	58	52	285,800	71	0	0	1	72
11	80	64	52	287,700	139	0	0	1	140
12	84	58	53	289,600	119	0	0	0	119
13	80	67	53	291,600	96	0	0	3	99
14	74	60	52.5	291,600	62	0	0	1	63
15	70	53	53	299,200	41	0	0	0	41
16	70	55	53.5	299,200	57	0	0	0	57
17	70	47	54	295,400	56	0	0	0	56
18	68	48	54	301,100	42	0	0	1	43
19	65	53	54	302,900	30	0	0	1	31
20	64	49	54	309,900	112	0	0	1	113
21	74	52	54	302,900	60	0	0	1	61
22	81	55	55	295,400	94	0	0	1	95
23	86	54	55	283,900	79	0	0	0	79
24	84	--	56	274,800	226	0	0	1	227
25	78	69	56	257,300	288	0	0	0	288
26	74	60	56	250,600	217	0	0	0	217
27	85	53	56	247,300	266	0	0	1	267
28	92	61	56.5	250,600	432	0	0	0	432
29	88	65	57	258,900	311	0	0	0	322
30	81	67	57	276,600	316	0	0	0	444

1/ Surface temperatures, taken with pocket thermometer, are given in degrees Fahrenheit.

Table 8.--Daily temperatures, stream flow, and fish count data, Rock Island Dam, July 1960.

Date	Air temperatures Max.	Air temperatures Min.	Water temperature 1/	Stream flow (c.f.s.)	Chinook	Sockeye	Coho	Steelhead	Total
July 1	75	61	57	287,700	286	210	0	0	496
2	84	55	56	302,900	256	265	0	0	521
3	87	61	57	302,900	205	365	0	2	572
4	88	64	56	302,900	333	461	0	0	794
5	92	65	57.5	306,400	211	576	0	0	787
6	99	66	58	311,600	210	572	0	0	782
7	95	72	58	315,100	195	862	0	1	1,058
8	90	64	58	311,600	158	986	0	0	1,144
9	86	68	58	295,400	98	1,539	0	0	1,637
10	87	64	58	291,600	130	1,973	0	0	2,103
11	82	69	58	291,600	209	2,740	0	0	2,949
12	82	70	59	274,800	162	2,481	0	0	2,643
13	94	70	60	267,500	160	2,683	0	0	2,843
14	95	62	60	263,900	84	1,855	0	0	1,939
15	94	67	60.5	252,300	137	2,609	0	0	2,746
16	100	75	60	247,300	137	3,020	0	0	3,157
17	102	74	60.5	250,600	112	3,182	0	0	3,294
18	104	69	61	252,300	182	2,526	0	0	2,708
19	97	78	61.5	245,700	182	3,391	0	1	3,574
20	94	82	61.5	242,600	102	3,022	0	1	3,125
21	92	81	62	239,400	82	2,242	0	1	2,325
22	82	74	62	230,000	130	2,077	0	2	2,209
23	92	70	62	222,600	161	1,431	0	3	1,595
24	86	61	61.5	221,100	87	1,349	0	9	1,445
25	86	61	61.5	216,300	110	1,420	0	4	1,534
26	91	72	62	205,800	99	1,000	0	5	1,104
27	93	71	62	192,800	167	1,003	0	6	1,176
28	99	77	62.5	186,500	119	1,198	0	1	1,318
29	92	64	62.5	167,700	181	784	0	7	972
30	91	71	63	167,700	137	755	0	14	906
31	92	68	63	156,900	142	455	0	17	614

1/ Surface temperatures, taken with pocket thermometer, are given in degrees Fahrenheit.

Table 9. --Daily temperatures, stream flow, and fish count data, Rock Island Dam, August 1960.

Date	Air temperatures		Water temperature 1/	Stream flow (c.f.s.)	Chinook	Sockeye	Coho	Steelhead	Total
	Max.	Min.							
Aug. 1	84	71	63.5	151,800	193	1,164	0	18	1,375
2	82	62	64	154,800	160	777	0	25	962
3	82	62	63	154,800	516	762	0	16	1,294
4	83	62	63	160,100	200	550	0	17	767
5	87	62	63.5	163,300	226	752	0	47	1,025
6	96	65	63.5	153,800	228	603	0	35	866
7	95	68	64	160,100	302	540	0	54	896
8	92	65	64	139,100	215	538	0	55	808
9	95	58	64	145,800	208	563	0	67	838
10	98	69	64.5	143,900	327	566	0	40	933
11	98	74	64.5	146,800	377	617	0	44	1,038
12	89	70	64.5	144,800	273	359	0	67	699
13	82	65	64	123,300	301	295	0	57	653
14	77	59	64	131,900	167	294	0	90	551
15	73	51	64	118,200	116	224	0	68	408
16	80	60	63.5	122,400	115	228	0	58	401
17	88	65	64	122,400	65	178	0	49	292
18	94	64	64	120,700	44	186	0	42	272
19	86	68	63.5	114,100	106	231	0	28	365
20	84	60	63.5	105,600	77	132	0	20	229
21	72	62	63.5	106,300	72	132	0	31	235
22	74	46	62.5	101,200	113	104	0	40	257
23	68	52	62.5	97,700	91	81	0	36	208
24	74	51	62	97,700	77	72	0	19	168
25	70	54	62.5	96,300	80	120	0	24	224
26	72	54	63	87,500	141	138	0	48	327
27	75	50	62	88,200	122	97	0	42	261
28	75	55	62	82,300	114	67	0	26	207
29	72	61	61.5	74,600	285	54	0	53	392
30	80	55	61.5	78,400	189	60	0	42	291
31	72	62	62	75,200	192	87	0	69	348

1/ Surface temperatures, taken with pocket thermometer, are given in degrees Fahrenheit.

Table 10.--Daily temperatures, stream flow, and fish count data, Rock Island Dam, September 1960.

Date	Air temperatures		Water temperature 1/	Stream flow (c.f.s.)	Chinook	Sockeye	Coho	Steelhead	Total
	Max.	Min.							
Sept. 1	66	56	62.5	84,900	174	78	0	74	326
2	77	47	62	66,100	187	38	0	54	279
3	82	55	62	66,100	148	79	0	44	271
4	80	64	62	61,000	183	94	3	63	343
5	73	69	63.5	65,000	168	64	2	74	308
6	73	66	62	58,800	129	30	0	88	247
7	83	49	61.5	72,700	154	5	0	83	242
8	80	50	61.5	74,600	156	19	0	71	246
9	74	55	62	80,300	155	19	0	97	271
10	81	55	62	86,300	177	19	0	80	276
11	86	55	61.5	75,200	159	7	0	54	220
12	89	59	63	75,200	239	22	0	89	350
13	91	63	63	70,200	235	27	0	134	396
14	90	62	64	70,800	217	23	0	99	339
15	90	61	65	73,400	208	23	0	96	327
16	81	55	64	63,800	232	4	0	179	415
17	83	58	63	69,000	192	5	0	141	338
18	88	58	62.5	66,100	137	1	0	122	260
19	81	62	63.5	65,000	249	0	4	130	383
20	73	52	62	69,000	250	12	0	198	460
21	72	44	61	65,000	189	9	0	187	385
22	64	45	61	72,700	183	3	3	160	349
23	75	50	61.5	78,400	91	2	1	90	184
24	69	55	61	80,300	110	8	11	127	256
25	80	55	61	81,000	46	3	10	95	154
26	79	48	61	79,700	81	1	3	78	163
27	79	48	61.5	80,300	92	2	4	74	172
28	82	52	61.5	84,200	126	0	3	86	215
29	84	52	61.5	83,600	96	0	4	59	159
30	84	52	61	79,100	90	0	4	66	160

1/ Surface temperatures, taken with pocket thermometer, are given in degrees Fahrenheit.

Table 11.--Daily temperatures, stream flow, and fish count data, Rock Island Dam, October 1960.

Date	Air temperatures		Water temperature 1/	Stream flow (c.f.s.)	Chinook	Sockeye	Coho	Steelhead	Total
	Max.	Min.							
Oct. 1	80	52	61	81,000	52	0	2	38	92
2	82	50	61	71,500	64	0	1	33	98
3	74	50	61	69,000	66	0	4	72	142
4	76	51	61	78,400	80	0	7	45	132
5	78	51	60	67,900	76	0	3	48	127
6	78	52	60	70,800	55	0	9	114	178
7	64	54	59.5	70,200	45	0	0	62	107
8	60	44	59	56,000	14	1	0	52	67
9	63	39	59	61,600	27	0	0	41	68
10	66	39	58.5	65,000	35	0	2	46	83
11	61	43	58.5	60,500	33	0	1	24	58
12	58	50	58	53,200	31	0	3	22	56
13	64	40	58	69,600	21	0	0	19	40
14	62	41	58	69,000	20	0	1	40	61
15	65	47	58	71,500	20	0	1	23	44
16	72	46	58	69,600	13	0	0	23	36
17	76	46	58.5	67,300	12	0	1	26	39
18	71	42	59	54,900	8	0	0	21	29
19	62	43	59	58,200	17	0	1	30	48
20	65	49	59	54,300	14	0	2	30	46
21	61	54	58	54,900	9	0	0	21	30
22	66	51	58.5	54,300	16	0	0	27	43
23	64	51	58.5	53,800	16	0	0	26	42
24	61	50	59	49,700	18	0	2	18	38
25	56	45	59	63,800	15	0	1	36	52
26	62	49	59	70,200	18	0	0	20	38
27	55	42	59	79,100	12	1	1	23	37
28	61	39	59	81,600	14	0	0	34	48
29	57	37	57.5	69,000	15	0	0	35	50

1/ Surface temperatures, taken with pocket thermometer, are given in degrees Fahrenheit.

Table 12.--Number and percent of sockeye salmon (large) counted over each ladder, Rock Island Dam, 1960.

Date	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	
May 2-15	0	0	0	0	0	0	0
May 16-31	0	0	0	0	0	0	0
June 1-15	0	0	0	0	0	0	0
June 16-30	73	65.18	34	30.36	5	4.46	112
July 1-15	10,054	56.25	5,171	28.93	2,648	14.82	17,873
July 16-30	16,108	61.40	5,608	21.37	4,520	17.23	26,236
Aug. 1-15	5,854	77.46	566	7.49	1,137	15.05	7,557
Aug. 16-31	1,359	80.04	50	2.94	289	17.02	1,698
Sept. 1-15	330	68.89	57	11.90	92	19.21	479
Sept. 16-30	42	85.72	6	12.24	1	2.04	49
Oct. 1-15	1	100.00	0	0	0	0	1
Oct. 16-29	1	100.00	0	0	0	0	1
Total	33,822	62.63	11,492	21.28	8,692	16.09	54,006

Table 13.--Number and percent of sockeye salmon (small) counted over each ladder, Rock Island Dam, 1960.

Date	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	
May 2-15	0	0	0	0	0	0	0
May 16-31	0	0	0	0	0	0	0
June 1-15	0	0	0	0	0	0	0
June 16-30	8	29.63	18	66.67	1	3.70	27
July 1-15	1,068	46.35	964	41.84	272	11.81	2,304
July 16-31	1,211	46.24	882	33.68	526	20.08	2,619
Aug. 1-15	750	71.63	119	11.37	178	17.00	1,047
Aug. 16-31	226	84.01	11	4.09	32	11.90	269
Sept. 1-15	37	54.41	9	13.24	22	32.35	68
Sept. 16-30	1	100.00	0	0	0	0	1
Oct. 1-15	0	0	0	0	0	0	0
Oct. 16-29	0	0	0	0	0	0	0
Total	3,301	52.11	2,003	31.62	1,031	16.27	6,335

Table 14.--Number and percent of steelhead trout counted over each ladder, Rock Island Dam, 1960.

Date	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	
May 2-15	199	39.96	72	14.46	227	45.58	498
May 16-31	146	57.48	62	24.41	46	18.11	254
June 1-15	6	24.00	9	36.00	10	40.00	25
June 16-30	6	85.71	1	14.29	0	0	7
July 1-15	3	100.00	0	0	0	0	3
July 16-31	56	78.87	1	1.41	14	19.72	71
Aug. 1-15	615	87.86	16	2.28	69	9.86	700
Aug. 16-31	496	79.11	15	2.39	116	18.50	627
Sept. 1-15	896	74.67	81	6.75	223	18.58	1,200
Sept. 16-30	1,388	77.45	89	4.97	315	17.58	1,792
Oct. 1-15	518	76.29	78	11.49	83	12.22	679
Oct. 16-29	303	81.89	27	7.30	40	10.81	370
Total	4,632	74.40	451	7.24	1,143	18.36	6,226

Table 15.--Miscellaneous fish count, Rock Island Dam, May 1960.

Date	Sucker	Squawfish	Whitefish	Chub	Dolly Varden	Rainbow trout	Other 1/	Total
May 1	--	--	--	--	--	--	--	--
2	7	13	190	0	0	0	0	210
3	9	14	67	0	0	0	0	90
4	0	9	91	0	0	0	0	100
5	1	2	156	2	0	0	0	161
6	1	4	28	0	0	0	0	33
7	0	2	14	0	0	0	0	16
8	0	98	211	0	0	0	0	309
9	0	0	143	0	0	0	0	143
10	2	13	92	0	0	0	0	107
11	4	24	151	0	0	0	0	179
12	542	4	58	0	0	0	0	604
13	641	1	25	0	0	0	0	667
14	245	1	28	0	0	1	0	275
15	122	0	27	0	0	0	0	149
16	40	2	8	0	0	0	0	50
17	36	1	12	0	0	0	0	49
18	19	8	19	0	0	0	0	46
19	21	0	32	0	0	0	0	53
20	39	1	51	0	0	0	0	91
21	55	8	34	0	0	0	0	97
22	83	0	50	0	0	0	0	133
23	126	7	39	0	0	2	0	174
24	226	39	114	0	0	0	0	379
25	140	8	47	0	0	0	0	195
26	281	6	28	0	0	0	0	315
27	296	25	41	0	0	0	0	362
28	315	20	32	0	0	0	0	367
29	850	31	61	0	0	0	0	942
30	1,872	64	25	0	0	0	0	1,961
31	1,233	101	55	0	0	0	0	1,389
Total	7,206	506	1,929	2	0	3	0	9,646

1/ Carp, lamprey, etc.

Table 16.--Miscellaneous fish count, Rock Island Dam, June 1960.

Date	Sucker	Squawfish	Whitefish	Chub	Dolly Varden	Rainbow trout	Other[1/]	Total
June 1	424	51	42	0	0	0	0	517
2	534	75	14	0	0	0	0	623
3	1,067	110	31	0	0	0	0	1,208
4	402	59	26	0	0	0	0	487
5	324	51	32	0	0	0	0	407
6	162	54	28	0	0	0	0	244
7	82	44	16	0	0	0	0	142
8	72	23	4	0	0	0	0	99
9	94	38	5	0	0	0	0	137
10	211	60	11	0	0	0	1	283
11	504	59	18	1	0	0	0	582
12	507	89	3	0	0	0	0	599
13	1,478	157	38	21	0	0	0	1,694
14	344	110	28	7	0	0	0	489
15	514	78	11	1	0	0	2	606
16	335	82	0	0	0	0	0	417
17	362	58	11	0	0	0	1	432
18	472	98	18	8	0	0	2	598
19	825	73	10	4	0	0	0	912
20	1,021	87	7	4	0	0	0	1,119
21	450	162	10	0	0	0	2	624
22	1,980	302	25	12	0	0	1	2,320
23	1,980	281	5	12	0	0	0	2,278
24	2,849	390	9	42	0	0	2	3,292
25	1,634	283	31	41	0	0	4	1,993
26	2,514	217	15	101	0	0	0	2,847
27	1,486	161	12	50	0	0	7	1,716
28	1,943	170	19	24	0	0	0	2,156
29	5,740	278	25	76	0	0	2	6,121
30	5,159	252	18	151	0	0	4	5,584
Total	35,469	3,952	522	555	0	0	28	40,526

1/ Carp, lamprey, etc.

Table 17.--Miscellaneous fish count, Rock Island Dam, July 1960.

Date	Sucker	Squawfish	Whitefish	Chub	Dolly Varden	Rainbow trout	Other[1/]	Total
July 1	1,613	171	11	68	0	0	5	1,868
2	479	61	11	31	0	0	10	592
3	220	100	9	11	0	0	1	341
4	144	74	3	48	0	0	23	292
5	504	152	18	96	0	0	12	782
6	608	98	15	87	0	0	12	820
7	821	194	1	58	0	0	11	1,085
8	818	170	3	106	0	0	15	1,112
9	378	137	0	22	0	0	16	553
10	288	58	0	14	0	0	0	360
11	550	52	0	12	0	0	15	629
12	518	55	0	20	0	0	17	610
13	1,812	277	4	90	0	0	37	2,220
14	927	75	0	44	0	0	17	1,063
15	800	91	0	32	0	0	34	957
16	747	69	0	17	0	0	60	893
17	1,099	127	0	46	0	0	46	1,318
18	964	65	0	14	0	0	74	1,117
19	645	69	1	54	0	0	46	815
20	437	95	0	106	0	0	42	680
21	336	62	0	72	0	0	28	498
22	239	56	2	39	0	0	83	419
23	171	41	6	42	0	0	61	321
24	247	33	6	36	0	0	68	390
25	204	50	1	54	0	0	88	397
26	250	43	3	70	0	0	24	390
27	255	57	13	85	0	0	32	442
28	467	71	0	99	0	0	54	691
29	259	37	1	77	0	0	97	471
30	448	53	4	34	0	0	103	642
31	199	57	7	8	0	0	49	320
Total	17,447	2,750	119	1,592	0	0	1,180	23,088

1/ Carp, lamprey, etc.

Table 18.--Miscellaneous fish count, Rock Island Dam, August 1960.

Date	Sucker	Squawfish	Whitefish	Chub	Dolly Varden	Rainbow trout	Other[1/]	Total
Aug. 1	1,156	140	10	69	0	0	92	1,467
2	963	52	6	35	0	0	52	1,108
3	906	77	2	39	0	0	39	1,063
4	565	16	0	85	0	0	61	727
5	445	4	1	58	0	0	84	592
6	395	37	12	31	0	0	54	529
7	880	64	2	26	0	0	48	1,020
8	957	99	10	69	0	0	56	1,191
9	715	17	4	45	0	0	57	838
10	417	42	3	67	0	0	78	607
11	371	22	1	79	0	0	71	544
12	160	7	5	52	0	0	67	291
13	60	13	2	36	0	0	24	135
14	158	34	11	68	0	0	20	291
15	119	35	10	32	0	0	9	205
16	232	60	25	67	0	0	18	402
17	460	68	19	49	0	0	53	649
18	864	15	16	56	0	0	35	986
19	599	20	12	33	0	0	84	748
20	974	40	12	9	0	0	120	1,155
21	758	29	7	39	0	0	50	883
22	413	44	13	32	0	0	99	601
23	376	50	14	65	0	0	90	595
24	261	50	14	42	0	0	112	479
25	356	23	4	53	0	0	63	499
26	464	9	3	45	0	0	100	621
27	327	23	15	30	0	0	121	516
28	718	31	15	33	0	0	78	875
29	249	46	16	32	0	0	51	394
30	1,427	71	30	16	0	0	25	1,569
31	751	48	44	31	0	0	89	963
Total	17,496	1,286	338	1,423	0	0	2,000	22,543

1/ Carp, lamprey, etc.

Table 19.--Miscellaneous fish count, Rock Island Dam, September 1960.

Date	Sucker	Squawfish	Whitefish	Chub	Dolly Varden	Rainbow trout	Other[1/]	Total
Sept. 1	688	13	30	34	0	0	36	801
2	299	16	18	4	0	0	24	361
3	467	23	38	8	0	0	48	584
4	600	38	27	34	0	0	58	757
5	652	49	30	58	0	1	25	815
6	483	68	66	54	0	0	5	676
7	830	87	82	57	0	0	20	1,076
8	669	93	109	47	0	0	63	981
9	405	67	75	51	0	0	71	669
10	957	163	143	27	0	0	90	1,380
11	1,137	122	45	70	0	0	59	1,433
12	1,463	158	86	66	0	0	37	1,810
13	907	181	148	104	0	0	39	1,379
14	1,050	144	72	85	0	0	14	1,365
15	491	32	22	33	0	0	17	595
16	441	80	71	38	0	0	12	642
17	232	89	129	31	0	0	2	483
18	587	57	126	38	0	0	4	812
19	327	37	104	30	0	0	4	502
20	404	43	75	33	0	0	4	559
21	381	65	87	37	0	0	16	586
22	683	78	128	23	0	0	21	933
23	606	64	183	39	0	0	9	901
24	679	66	199	50	0	0	12	1,006
25	1,048	47	87	47	0	0	10	1,239
26	1,283	73	76	51	0	0	23	1,506
27	1,247	92	76	50	0	0	24	1,489
28	978	85	100	57	0	0	29	1,249
29	565	106	98	92	0	0	24	885
30	547	78	262	174	0	0	22	1,083
Total	21,106	2,314	2,792	1,522	0	1	822	28,557

1/ Carp, lamprey, etc.

Table 20.--Miscellaneous fish count, Rock Island Dam, October 1960.

Date	Sucker	Squawfish	Whitefish	Chub	Dolly Varden	Rainbow trout	Other[1/]	Total
Oct. 1	949	54	97	60	0	0	10	1,170
2	595	77	135	24	0	0	3	834
3	677	54	205	27	0	0	10	973
4	787	62	465	13	0	0	10	1,337
5	361	57	168	19	0	0	6	611
6	115	31	97	0	0	0	9	252
7	95	93	376	36	0	0	0	600
8	72	16	305	72	0	0	1	466
9	47	4	282	12	0	0	0	345
10	80	27	222	0	0	0	0	329
11	71	28	348	0	0	0	4	451
12	47	26	314	0	0	0	0	387
13	175	32	190	0	0	0	2	399
14	276	27	650	0	0	0	2	955
15	409	28	517	0	0	0	2	956
16	157	13	505	0	0	0	0	675
17	201	56	653	0	0	0	0	919
18	259	43	1,123	0	0	0	5	1,430
19	186	42	1,342	0	0	0	0	1,570
20	279	30	1,035	0	0	0	3	1,347
21	142	17	1,162	0	0	0	3	1,324
22	237	22	1,138	0	0	1	2	1,400
23	138	19	1,439	0	0	0	2	1,598
24	108	11	1,238	0	0	0	2	1,359
25	576	28	431	0	0	0	0	1,035
26	677	12	521	0	0	0	0	1,210
27	286	12	1,055	0	0	0	0	1,353
28	184	7	840	0	0	0	0	1,031
29	98	4	859	0	0	0	1	962
Total	8,284	932	17,712	263	0	1	77	27,269

1/ Carp, lamprey, etc.

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